

Trigen Energy Corporation – Trenton, New Jersey

Background

The city of Trenton, New Jersey used a grant from the United States Department of Energy to conduct a cogeneration project feasibility study. Officials found that the city could save money by building a cogeneration plant. In order to limit their costs, the city contracted with Trigen Energy Corporation (a developer, owner, and operator of industrial, commercial, institutional, and district energy systems in North America) to build and operate a new cogeneration facility. Trigen developed the district energy system in 1983 to provide for the thermal and electricity needs of 40 buildings in downtown Trenton. When the system came online, it displaced 50 separate boilers and 30 separate chillers. Since then, four new office buildings covering 200,000 to 500,000 square feet have signed up with the facility.

Project Description

Trigen - Trenton consists of two natural-gas fueled internal combustion engines with capacities of 6 MW_e each. The system is primarily gas fired but can also use diesel fuel. Waste heat from the engines produces high temperature hot water. An underground distribution network channels thermal output from the plant to service the city's heating load and the local utility purchases the electricity.

In 1985, Trigen began expanding the facility to accommodate district cooling by using waste heat from electricity generation during summer. When the cooling system initially came online in 1988, it began by serving three state buildings. In 2001, service expanded to 31 buildings. A mix of hot water/steam absorption and electric chillers (a combined capacity of 7,500 tons) produce chilled water. A 2.6 million gallon Thermal Energy Storage (TES) chilled water system was installed in 1989 to match the city's cooling load and meet peak demand. The tank, which stores chilled water at night for use during the day, reduces the number of electric chillers that must operate and improves the efficiency of the cooling system. In addition, desiccant dehumidification systems in customer buildings allow more precise control of interior conditions.

Trigen – Trenton Plant Operating Data for 1999*	
Project Design Capacity (MW _e)	12
Power to Heat Ratio	0.6
Total Net Efficiency (HHV)	75%
% Fuel Savings ¹	13% (2,900 metric tons of carbon)
Effective Electric Efficiency (HHV) ²	68%

**Data based on 8,760 annual hours of operation*

¹ Savings based on 50% efficient electric and 80% efficient thermal generation with natural gas as the primary fuel.

² Effective Electric Efficiency = (CHP power output)/(Total energy input to CHP system – total heat recovered/0.8). Assumes thermal output provided at 80% efficiency.

Success Strategy

To avoid paying all the construction and maintenance costs by itself, Trigen partnered with another private company. The private company keeps the returns from electricity sales while Trigen retained profits from district heating and cooling services. The agreement allowed Trigen to move forward by reducing its initial capital investment.

Benefits

The Trenton cogeneration plant encourages commercial development in downtown Trenton by providing low-cost heating and cooling. The plant has been well-received by institutional and commercial customers, and has seen a growing client roster since development was completed in 1989. According to Alan Mallach, the Director of the Department of Housing and Development for the city of Trenton, “The city has realized some energy efficiencies and cost savings, and customers are satisfied with the service.”

The efficiency improvements have provided a substantial environmental benefit as well – conserving 190 million standard cubic feet of natural gas and 2,500 barrels of oil and reducing emissions of carbon dioxide by 12,000 tons annually compared to separate heat and power. This is equivalent to planting 3,200 acres of forest or displacing the annual greenhouse gas emissions from 1,000 households.

In March 2000, the United States Environmental Protection Agency and the Department of Energy recognized the pollution prevention benefits of this CHP facility with an ENERGY STAR® CHP Award. For more information on ENERGY STAR® CHP awards, please click [here](#).